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(54) **Locating machines on computer networks**

(57) A location code indicates the physical location of a computer station of interest on a computer network such as NetBIOS Network. When a user connects to the computer network, the user specifies a location code indicative of the physical location of the particular computer station on which the user is operating. The location codes are stored in name tables of the computer sta-

tions if those location codes are unique, i.e., not stored in the name tables of any other computer station on the computer network. To determine the physical location of a computer station of interest, an interrogation of the name table of the computer station of interest is performed using the hexadecimal address of the computer station of interest.

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## Description

The present invention relates to the field of computer networks, and more particularly to a method and apparatus adapted to determine the physical location of a station on a computer network.

A computer network comprises a plurality of stations physically attached to the computer network at different locations. It is often difficult to determine the specific physical location of a station on a large computer network. In a NetBIOS based network, each station has a unique hexadecimal address; if a particular station is causing a problem on the network, typical prior art systems can ascertain the hexadecimal address of that station, but determining the specific physical location of the problematic station is often time consuming and difficult. Specifically, the typical prior art systems utilize packet trace analysis which involves capturing all data packets transmitted over the computer network and decoding the captured data packets. The result of packet trace analysis is the retrieval of the hexadecimal address of the problematic station.

To determine the physical location of the problematic station, a detailed list of hexadecimal addresses and the corresponding physical locations is required. This list must be continuously updated whenever a station is added to the computer network or physically moved or removed. In the absence of such a list, the process for finding the problematic station can be laborious and time consuming.

It is an object of the invention to provide an efficient, simple and reliable method and apparatus for determining the physical location of a station on a computer network.

According to the invention there is provided a method for determining a physical location of a computer station on a computer network, wherein each computer station on the computer network includes an address identifying said computer station, a name table for storing names, and a memory, characterized by the steps of:

specifying a location code for said computer station said location code indicating a physical location of said computer station;  
checking that said location code is unique, that is, it is not stored in a name table of any other computer station on said computer network; and  
if said location code is unique posting said unique location code as a name in said name table of said station.

The invention will now be described by way of example only with reference to the accompanying drawings, in which:

Fig. 1 depicts a token-ring network;  
Fig. 2 depicts a station connected to the token-ring network depicted in Fig. 1; and

Fig. 3 depicts the well-known NetBIOS "INTERRUPT 2A" and "INTERRUPT 2F" CALLS.

Referring to Fig. 1, there is illustrated a token-ring local area network 102 with which the present invention may be utilized. The token-ring network has a plurality of endpoints, including stations 104, coupled to one another by cables 106. The stations 104 are of a multi-layered architecture of hardware, firmware and software.

Referring to Fig. 2, each of the stations 104 includes a computing unit 108, a display 110 such as a video display terminal, an input device 112, such as a keyboard, and a network adapter 113. The video display 110, input device 112 and network adapter 113 are coupled to the computer unit 108. Each of the computing unit 108 includes a processor 114 for interpreting and executing instructions, computer memory 116 for use in executing instructions and data storage means 118, among other components (not shown). The network adapters 113 are peripheral devices coupled to the computing units 108 and to cables 106 (Fig. 1). The network adapters 113 include read-only memory (ROM) 120 and random access memory (RAM) 122.

The stations 104 include networking software which is loaded into the computer memory 116 when the stations 104 are powered on or booted. The networking software permits the stations 104 to communicate with each other over the same local area network 102. Networking software comprises a variety of different software programs including a transport-level protocol and a session-level interface (also referred to herein as "session-level protocol") to the transport-level protocol. The transport-level protocol is software which provides a set of semantic and syntactic rules for reliable data transfer from one station 104 to another on the same local area network 102 using hexadecimal addresses. The session-level protocol is software used in conjunction with the transport-level protocol that allows point-to-point communication between named endpoints on the local area network 102. Hexadecimal addresses and named endpoints will be explained below. The preferred session-level protocol of the present invention is a well-known Network Basic Input/Output System (also referred to herein as "NetBIOS"). The present invention applies to any network transport-level protocol that supports a NetBIOS session-level interface.

Stored within each ROM 120 of the network adapters 113 is a unique hexadecimal address assigned to the particular network adapter 113 in which the ROM 120 resides. The hexadecimal address identifies the station 104 on the local area network 102 to which that particular network adapter 113 is coupled. To transmit data from one station 104 to another, the transport-level protocol must be provided with the hexadecimal address of the receiving station 104. In NetBIOS based networks, each station 104 also has a unique one-to-sixteen character network name. These stations 104

with network names are named endpoints on the local area network 102. The NetBIOS session-level interface includes software that translates the network name to the hexadecimal address stored in the ROM 120 of the network adapter 113. Thus, the NetBIOS session-level protocol permits data transfer from one station 104 to another station 104 using network names instead of hexadecimal addresses.

The NetBIOS session-level interface further includes software for storing the network name in a name table. The phrase "name table" is a conceptual term that refers to an area of memory located typically in the RAM 122 of the network adapter 113 for storing a multitude of names. The phrase "local name table" refers to a name table located on a particular station 104 to which the network adapter 113 is coupled. Before any network names are added to or posted in any local name table on the local area network 102, a data broadcast is performed, i.e., the same data is transmitted to all stations 104 on the local area network 102. The broadcast ensures that the network name to be posted is a unique name on the local area network 102, i.e., no local name table connected to the local area network 102 already contains the name to be posted. If the network name to be posted already exists, an error code is returned. Otherwise the network name is posted in the local name table. One embodiment of the present invention uses the well-known NetBIOS "ADD NAME" command to post the network name in the local name table.

Determining the physical location of a station on a local area network comprises three operations: registration, posting and enumeration. Registration requires a user on the local area network 102 to designate a location code for the particular station 104 which is being operated by the user. The location code is indicative of the physical location of the particular station 104. For example, the location code could include the state, city and room number of the office where the station is located. Or it could be a telephone number or an E-mail address. Whatever the convention, the location code cannot be longer than sixteen characters. In the preferred embodiment of the present invention, the registration software runs automatically when the station 104 is powered on or booted and prompts the user on the local area network 102 to enter a location code. Upon input of the location code by the user, the registration software stores the location code in a file (also referred to herein as "location code file") on the data storage means 118 of the station 104 on which the location code is being specified.

The second operation is posting. Posting is the act of adding the location code as a name in the local name table of the network adapter 113 to which the particular station 104 is coupled. The present invention includes posting software that automatically detects whether networking software has been loaded into the computer memory 116 of the station 104 on which the location code is being specified. One embodiment of the present

invention utilizes a well-known NetBIOS "INTERRUPT 2A" or "INTERRUPT 2F" call, as shown in Fig. 3 by tables 202 and 204, respectively, to detect whether networking software has been loaded. Specifically, the INTERRUPT 2A and INTERRUPT 2F calls are used to instruct the processors 114 to check the computer memory 116 for the presence of the components that comprise the networking software, including the transport-level protocol and session-level interface. A successful INTERRUPT 2A or INTERRUPT 2F call indicates that the networking software has been loaded on the particular station 104 on which the location code is being specified. Upon detection of the networking software, the posting software references a location code file and checks whether the location code exists as a name in any local name table on the local area network 102 by attempting to post or add the location code as a name in the local name table. Posting is achieved programmatically using the well-known NetBIOS "ADD NAME" command. The location code will not be posted if either the location code is not a unique name on the local area network 102 or the networking software is not loaded on the station 104.

Once the location codes are posted in the local name table of every station on the local area network, the physical location of any station 104 on the local area network 102 can be determined. Enumeration software is provided for interrogating the local name table of a station of interest, such as a station causing a problem on the computer network or a station illegally connected to the computer network. To interrogate the local name table, the hexadecimal address of the station of interest must be known. In one embodiment of the present invention, a transport-level protocol analyzer is used to obtain the hexadecimal address of the station of interest. Preferably, the transport-level protocol analyzer utilizes a well-known packet trace analysis technique to capture all data packets transmitted over the cables 106 of the local area network 102 and to decode these data packets being captured into appropriate protocol information for debugging purposes. Included within the data packets are the hexadecimal addresses of the stations from which the data packets originated. The end result of packet trace analysis is the determination of the hexadecimal address of the station of interest. The manner in which packet trace analysis captures the data packets and decodes the captured data packets is well-known in the art. Some examples of commercial packet trace analysis products include the Sniffer from Network General Corporation and the LANalyzer from Excelan.

Once the hexadecimal address is known, the enumeration software can interrogate the local name table of the station of interest using the well-known NetBIOS "ADAPTER STATUS" command. Successful interrogation returns a list of the names posted in the local name table of the station of interest, which includes the network name and the location code.

## Claims

1. A method for determining a physical location of a computer station on a computer network, wherein each computer station on the computer network includes an address identifying said computer station, a name table for storing names, and a memory, characterized by the steps of:

specifying a location code for said computer station, said location code indicating a physical location of said computer station;  
checking that said location code is unique, that is, it is not stored in a name table of any other computer station on said computer network;  
and  
if said location code is unique posting said unique location code as a name in said name table of said computer station.

2. A method according to claim 1 characterized in that said address is a hexadecimal address and by comprising the additional steps of:

determining said hexadecimal address of a selected computer station on said computer network; and  
interrogating said name table of said selected computer station for said location code using said hexadecimal address being determined.

3. A method according to claim 2 characterized in that the step of determining said hexadecimal address of said selected computer station includes:

conducting a packet trace analysis of said computer network, said packet trace analysis including capturing data packets transmitted over said computer network, and decoding captured data packets to determine the hexadecimal addresses of the computer stations from which the captured data packets originated.

4. A method according to claim 1 characterized by the additional step of:

detecting whether networking software is present in the memory of said computer station for which said location code is being specified prior to the step of posting said location code, said networking software comprising software for enabling computer stations on said computer network to communicate with each other.

5. A method according to claim 4 characterized in that the step of detecting whether said networking software is present includes:

instructing a processor of said computer station for which said location code is being specified to examine said computer memory for the presence

of said networking software.

6. A method according to claim 4 characterized in that the step of detecting whether said networking software is present includes:

executing a NetBIOS INTERRUPT 2A call to examine said computer memory of said computer station on which said location code is being specified for presence of said networking software.

7. A method according to claim 4 characterized in that the step of detecting whether said networking software is present includes:

executing a NetBIOS INTERRUPT 2F call to examine said computer memory of said computer station for which said location code is being specified for presence of said networking software.

8. Apparatus for determining a physical location of a computer station 104 on a computer network, 102 wherein each computer station 104 includes a network adapter 113 and computer memory 116, said network adapter 113 having adapter memory 120 for storing an address identifying said computer station and a location code indicating said physical location of said computer station, characterized by comprising:

means for specifying a location code for a computer station on said computer network; and  
means 122 for storing said unique location code in said adapter memory of 120 said computer station, said means for storing said location code including  
means for determining whether said location code is unique, said location code being unique if said location code is not stored in said name table of any said computer station on said computer network.

9. Apparatus according to claim 8 characterized by further comprising:

means for detecting whether networking software is present in said computer memory of said computer station, said networking software including software that enables said computer station on said computer network to communicate with other said computer station on same said computer network.

**FIG. 1**

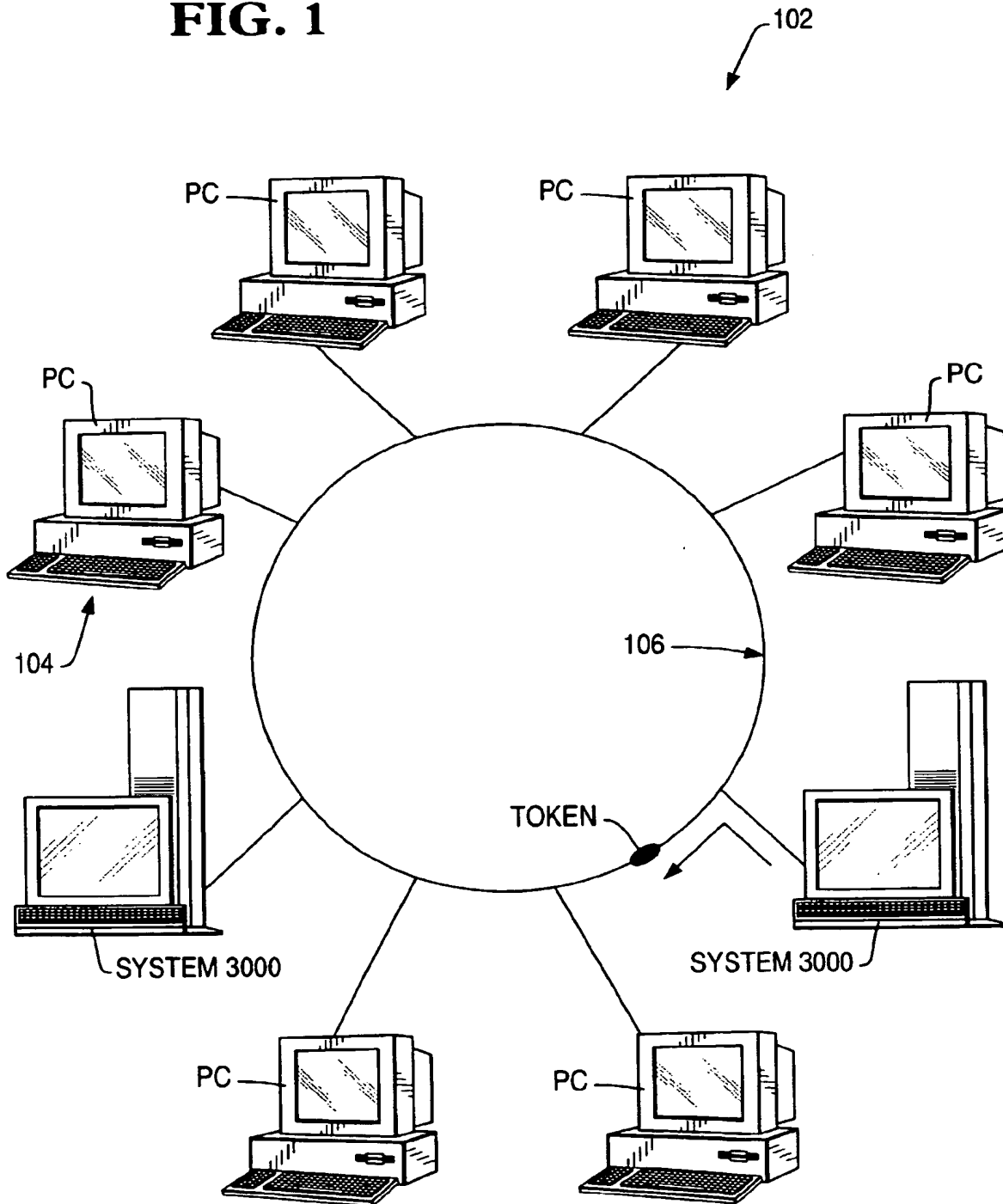


FIG. 2

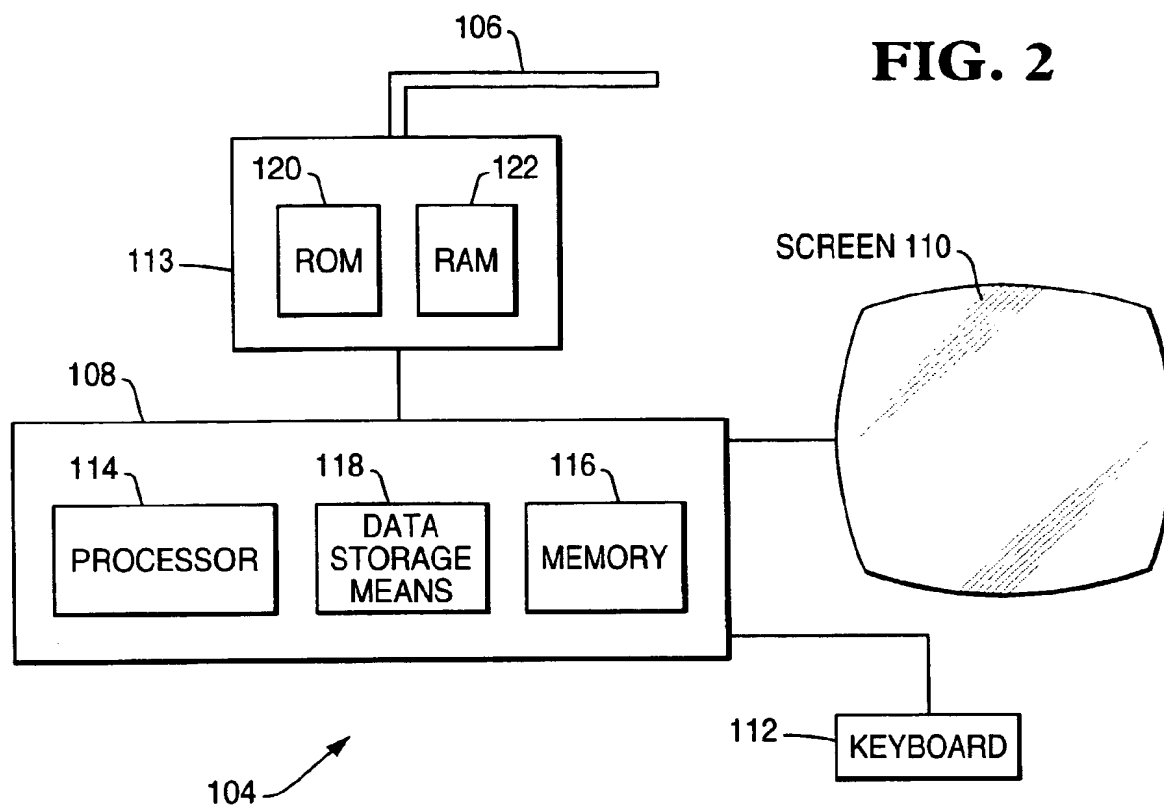


FIG. 3

INTERRUPT 2A

00	INSTALLATION CHECK	202
01	EXECUTE <b>NETBIOS</b> REQUEST	
02	SET <b>NET</b> PRINTER MODE	
03	GET DEVICE SHARED STATUS	

INTERRUPT 2F

BB	00	<b>NET</b> COMMAND INSTALLATION CHECK	204
	03	GET SERVER POST ADDRESS	
	04	SET SERVER POST ADDRESS	



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tions if those location codes are unique, i.e., not stored in the name tables of any other computer station on the computer network. To determine the physical location of a computer station of interest, an interrogation of the name table of the computer station of interest is performed using the hexadecimal address of the computer station of interest.

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# EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 8550

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A	DE 40 41 442 C (SIEMENS) 25 June 1992 (1992-06-25) * column 1, line 25 - line 35 * * column 1, line 61 - column 2, line 9 * * column 2, line 61 - line 65 *	1	
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The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 21 October 1999	Examiner Siebel, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 82 (P4/C01)



**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 96 30 8550

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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21-10-1999

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